



**Features**

From your Farm Advisors

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## Cultural Practices Key to Management of Whitefly-Transmitted Virus Diseases



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In the late 1920's, sweetpotato whitefly *Bemisia tabaci* (Gennadius) was first reported as a pest on southern California cotton and whitefly-transmitted virus disease problems have affected many crops since. Cotton leaf crumple (CLCr) disease, caused by *Cotton leaf crumple virus* (CLCrV), was the first serious whitefly-transmitted disease problem associated with *B. tabaci* in southern California and was reported in 1954. This disease outbreak was effectively managed by two control methods. The first method was regulatory control requiring elimination of ratoon cotton (cotton grown as a perennial). The second cultural control method, "sanitation," was physical elimination of ratoon cotton and volunteer cotton from scattered seed around fields and ditch banks by shredding, discing, and roguing. In 1981 CLCr disease again became an economic problem in southeastern California and Arizona with a severe outbreak of sweetpotato whitefly; now referred to as sweetpotato whitefly Biotype A or *B. tabaci* Biotype A, and again in the 1990's with the invasion of *B. tabaci* Biotype B also known as the silverleaf whitefly, *B. argentifolii* (Bellow and Perring). Currently CLCrD is not a major problem because of the limited production of cotton in the Imperial Valley.

Sweetpotato whitefly Biotype A was responsible for several other virus disease outbreaks during the late 1970's and early 1980's. Squash leaf curl (SLC) disease caused by the, *Squash leaf curl virus* (SLCV), was first reported infecting cucurbits in 1978. SLC disease severely reduced spring and fall production of zucchini and other summer-type squashes grown in southern California. The virus does not cause disease in melons or watermelons. The SLC disease contributed to the eventual elimination of banana squash, pumpkins, and other types of winter squashes grown during the summer months in southeastern California. Another disease contributing to the demise of squash production in the Imperial Valley was lettuce infectious yellows (LIY) caused by *B. tabaci*-transmitted *Lettuce infectious yellows virus* (LIYV). LIYV infects squashes and melons, including watermelon, and it caused economic losses in the 1980s. Because LIYV is not transmitted by *B. tabaci* Biotype B, it basically disappeared after the displacement of *B. tabaci* Biotype A by *B. tabaci* Biotype B in the early 1990s. Also during the early-1990's, a disease called tomato necrotic dwarf eliminated the fall production of tomatoes grown for planting seed in southeastern California. This disease was thought to be caused by a whitefly-transmitted virus (tentatively name Tomato necrotic dwarf virus), but the virus has yet to be well-characterized.

The lack of implementation of adequate regulatory and cultural control methods to supplement the use of then newly registered whitefly control insecticides made it difficult, if not impossible, to effectively manage levels of whitefly and virus disease in a number of crops in the Imperial Valley in the 1980's and 1990's. The near continuous production of cucurbit crops, large populations of volunteer melons during summer months following spring melon crops, the production of whitefly host bridge crops such as cotton, and the difficulty and high costs of summertime sanitation practices were all contributing factors working against efforts to successfully implement cultural management as part of an overall whitefly and virus disease IPM program.

Lettuce chlorosis (LC) disease, caused by *Lettuce chlorosis virus* (LCV), is another sweetpotato whitefly Biotype B-transmitted virus. It was first detected in infecting lettuce crops in the mid-1990's. LC disease was of little concern until the 2005/06 lettuce production season in southeastern California when there was severe damage to leaf lettuce types, especially Romaine. Little has been done to manage LC through cultural practices because it rarely causes severe economic losses.

During the 1998 fall melon production season, a new cucurbit virus disease, cucurbit leaf crumple (CuLCr), was discovered in the Imperial Valley. CuLCr disease is caused by the sweetpotato whitefly Biotype B-transmitted begomovirus (begomoviruses are whitefly-transmitted geminiviruses), *Cucurbit leaf crumple virus* (CuLCrV). This virus was identified and characterized in Robert Gilbertson's laboratory at UC Davis. CuLCr causes serious economic losses in squash production, but not in melon or watermelon production because plants recover from initial infections and produce acceptable yields. There has been little or no economic incentive for growers to implement cultural controls to protect the relatively small acreages of squash from whitefly-transmitted viruses. Rather, growers have essentially stopped producing squashes in the Imperial Valley.

Most recently, two new sweetpotato whitefly Biotype B-transmitted virus diseases have recently appeared in southern California. The first problem became apparent in the fall of 2006: cucurbit yellow stunting disorder (CYSD) disease caused by *Cucurbit yellow stunting disorder virus* (CYSDV), an exotic *Crinivirus*. This virus infects most types of cucurbits, including melons and watermelons, and has caused considerable economic damage in the Imperial Valley and Yuma, Arizona to melon crops. Several meetings to discuss CYSDV and its management were organized by UA Cooperative Extension and UC Cooperative Extension and include, melon growers, pest control advisors, and others. Although a cucurbit-free period along with extensive sanitation efforts were suggested, there was little interest among Imperial Valley growers to participate in a voluntary melon free period program to try and break the disease cycle of CYSD in southern California. However, Arizona growers implemented the voluntary melon free period with some success, and continue to grow fall melons. Although William Wintermantel, USDA ARS in Salinas, CA and Eric Natwick, UCCE, Imperial County identified several annual and perennial CYSDV host plants that bridge the gap of between spring and fall melon production perpetuating the CYSD cycle, we still recommend compliance with a voluntary melon free period to reduce the buildup of *B. tabaci* Biotype B population levels and CYSDV during the summer months to help reduce the potential of CYSDV transmission to fall cucurbit crops.

The second new virus disease identified in the Imperial Valley was tomato yellow leaf curl (TYLC) caused by the begomovirus *Tomato yellow leaf curl virus* (TYLCV). This exotic virus is the most recent whitefly-transmitted virus disease to appear in California and Arizona. It is one of the most damaging viruses of tomato and causes substantial economic losses to tomato production worldwide. Dr. Robert Gilbertson, Department of Plant Pathology, UC Davis, identified TYLCV in tomato samples collected by Eric Natwick from a noncommercial greenhouse in Brawley, CA in March 2007. Because TYLCV posed a threat to commercial tomato production statewide as well as production of pepper and tomato transplants in southeastern California, CDFA and the Imperial County Agricultural Commissioner implemented surveys to detect the incidence and spread of TYLCV. There was an eradication effort in Imperial County coordinated between CDFA and the Imperial County Agricultural Commissioner's Office, but TYLCV was subsequently found in the Coachella Valley in Riverside County, CA in 2008. Through surveys of commercial tomato fields, TYLCV has been detected by Natwick and Gilbertson in commercial tomato fields in Imperial County each year after the initial find in Brawley, CA. However, the tomato and pepper transplant industry in Imperial County has remained free of TYLCV, presumably because production occurs when whiteflies are absent or at low populations, and TYLCV has not been found elsewhere in California. TYLCV has a moderate host range including members of plant families including Solanaceae (tomato, peppers, various weeds, and ornamentals), Malvaceae (cheeseweed), and Fabaceae (beans). However, tomato is the host to which the virus is best adapted and that is most important to disease epidemiology. Therefore the disease can be managed through tomato-free periods and sanitation, whitefly management (cultural and chemical) and resistant varieties. Because tomato production is limited in the Imperial Valley, it does not appear that TYLCV that the incidence of TYLCV is increasing.

## Cultural Practices Key to Management of Whitefly-Transmitted Virus Diseases



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**Khaled Bali and Sharon Sparks\***

California Irrigation Management Information System (CIMIS) is a statewide network operated by California Department of Water Resources. Estimates of the daily reference evapotranspiration ( $ET_o$ ) for the period of June 1 to August 31 for three locations in the Imperial County are presented in Table 1.  $ET$  of a particular crop can be estimated by multiplying  $ET_o$  by crop coefficients. For more information about  $ET$  and crop coefficients, contact the UC Imperial County Cooperative Extension Office (352-9474) or the IID, Ag Water Science Unit (339-9082). Please feel free to call us if you need additional weather information, or check the latest weather data on the worldwide web (visit <http://tmdl.ucdavis.edu> and click on the CIMIS link).

Table 1. Estimates of daily Evapotranspiration ( $ET_o$ ) in inches per day

Station	June		July		August	
	1-15	16-30	1-15	15-31	1-15	16-31
Calipatria	0.39	0.40	0.39	0.38	0.35	0.32
El Centro (Seeley)	0.36	0.38	0.38	0.37	0.32	0.29
Holtville (Meloland)	0.38	0.39	0.39	0.38	0.34	0.31

\* Irrigation Management Unit, Imperial Irrigation District.

### **Link to UC Drought Management Publications**

<http://ucmanagedrought.ucdavis.edu/>